

CUMAS: a seafloor multi-sensor module for volcanic hazard monitoring

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Abstract A seafloor multi-sensor module with real-time data transmission, named CUMAS (Cabled Underwater Module for Acquisition of Seismological data), has been deployed in January 2008 in the Gulf of Pozzuoli, in the Campi Flegrei caldera (southern Italy), which is one of the most active volcanic areas in the world. The sensors installed in CUMAS were selected to monitor a set of signals related to the local seismicity as well as the ground uplift and subsidence of the seafloor that are related to the bradyseismic phenomenon. In particular, together with a broad-band three-component seismometer and a low-frequency hydrophone, a seafloor water-pressure sensor is used to assess the feasibility of measurements of the slow vertical movement of the seafloor (bradyseism).

Further sensors are acquired by two embedded Linux computers, namely tilt and heading sensors for the measure of the actual module orientation on the seafloor, and status sensors that monitor the state of health of the vessel (e.g., internal temperature, power absorption, water intrusion).

The underwater acquisition systems are linked to a support infrastructure, a floating buoy (elastic beacon), through an electro-mechanical cable with an Ethernet line. The buoy provides the needed power supply thanks to batteries charged by solar panels and a wind-generator. A Wi-Fi antenna on the buoy is used to transmit the seafloor data from the sea surface to the land acquisition centre in the city of Naples. A meteorological station is also mounted on the buoy, to allow the correlation of the air and seafloor data.

CUMAS, although based on commercial sensors, relies on an original system for the centralized management of a wide set of geophysical and physical oceanographic sensors, that handles the continuous data acquisition and real-time data transmission.

After the installation in the Gulf of Pozzuoli at about 100 m w.d., and after a test period, CUMAS uninterruptedly operated from May 2008 to June 2009, thus providing continuous geophysical data to the Monitoring Center of the Campi Flegrei volcanic areas, managed by the Istituto Nazionale di Geofisica e Vulcanologia.

The long-term operational performance of CUMAS is presented here, together with the first results from the analysis of the geophysical long time-series acquired.

Examples of the acquired signals, especially geophysical data, will be presented to point out the high quality in term of signal-to-noise ratio. In particular, earthquake recordings obtained from the hydrophone resulted of comparable quality to the seismic data acquired on land by the permanent network, thus demonstrating the suitability of hydrophones to monitor the seismic activity of the caldera.